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(54) Method of and machine for making filters for rod-shaped smokers' products

(57) Two or more tows of fibrous filter material are simultaneously advanced along neighboring paths through several processing units into a rod forming unit to be converted into filter rods which are ready to be subdivided into filter rod sections of unit length or multiple unit length, at least one of the processing units is designed to simultaneously treat all of the tows, and at least one of these units is designed to treat the tows independently of each other, such independent treatment renders it possible to eliminate differences between the characteristics of the ultimate products or to intentionally impart to products obtained from different rods different characteristics such as density and/or the resistance to the flow of tobacco smoke, the plural tows can be withdrawn from a single source storing a discrete bale for each tow, a common bale for several tows or a bale having a tow of multiple unit width which is subdivided into several narrower tows not later than at the time of entering the unit or units which are designed to individually treat each tow on its way toward the rod forming unit, the tows can be advanced side-by-side in a common plane or in several planes above each other.

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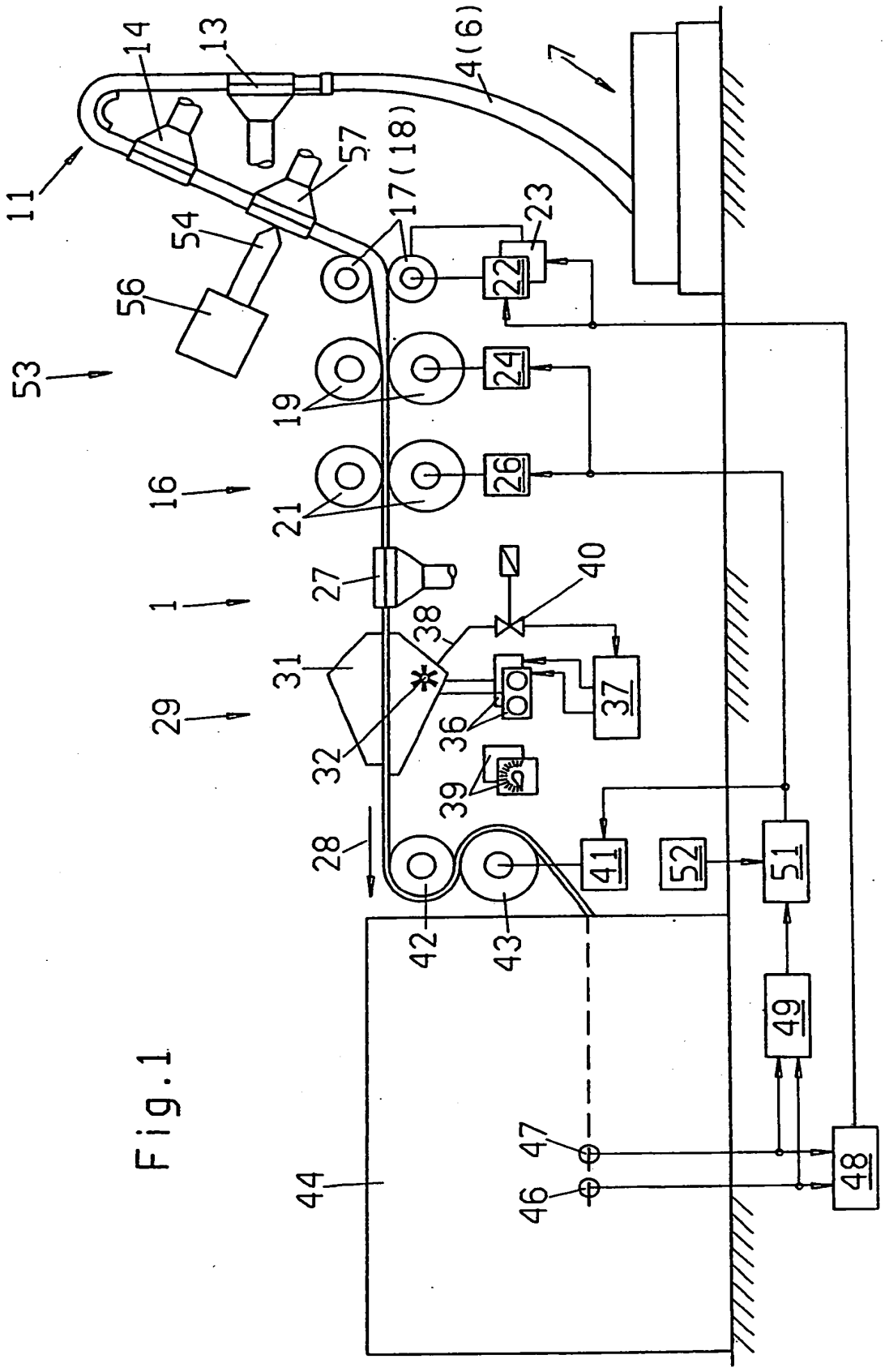
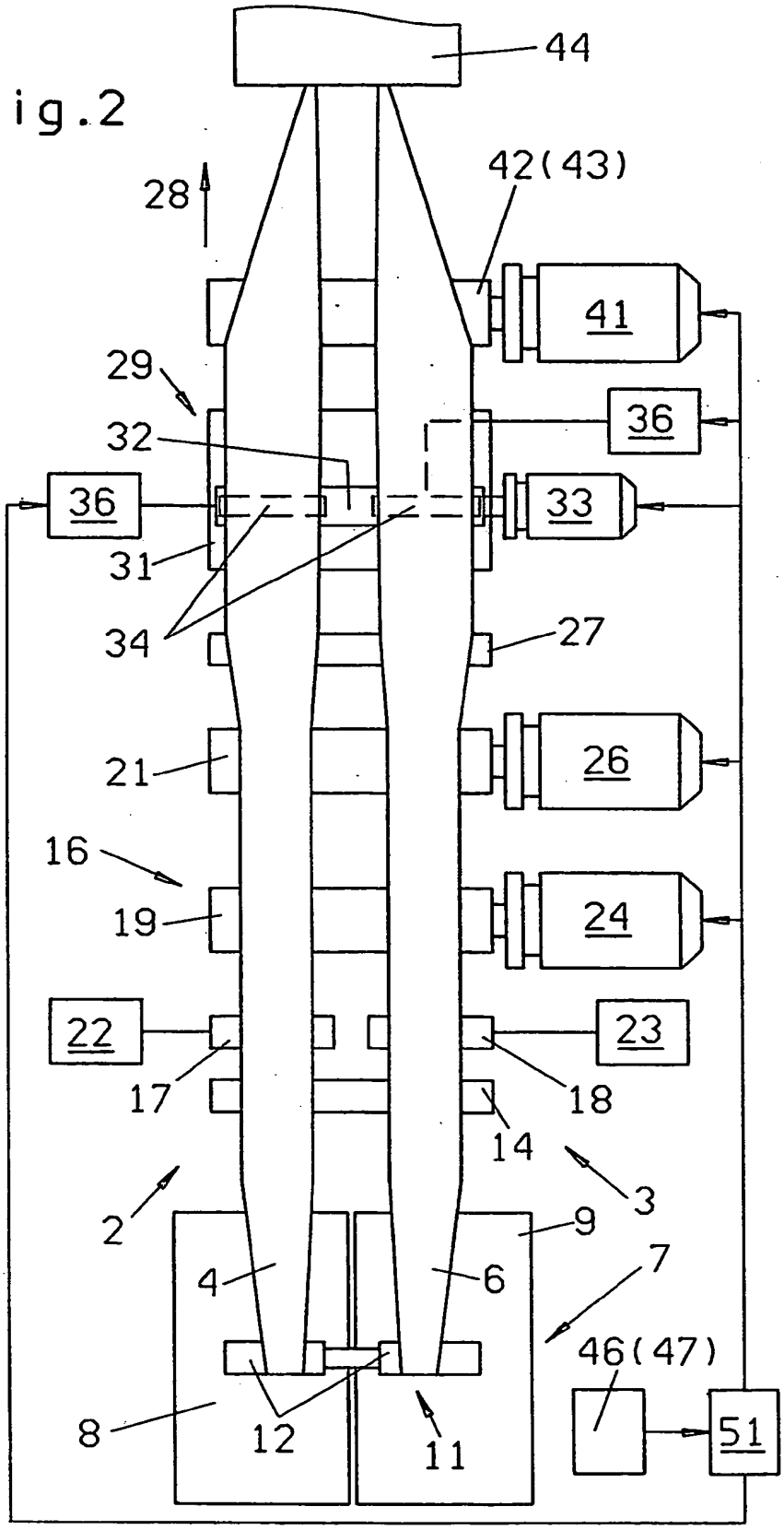


Fig.1

Fig.2



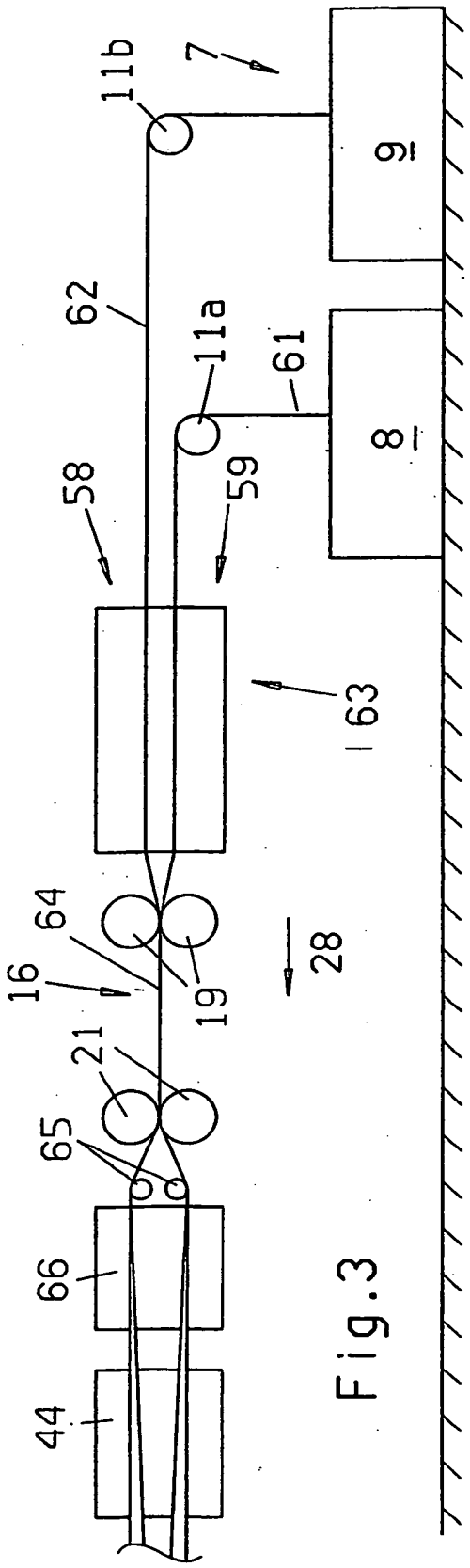


Fig.3

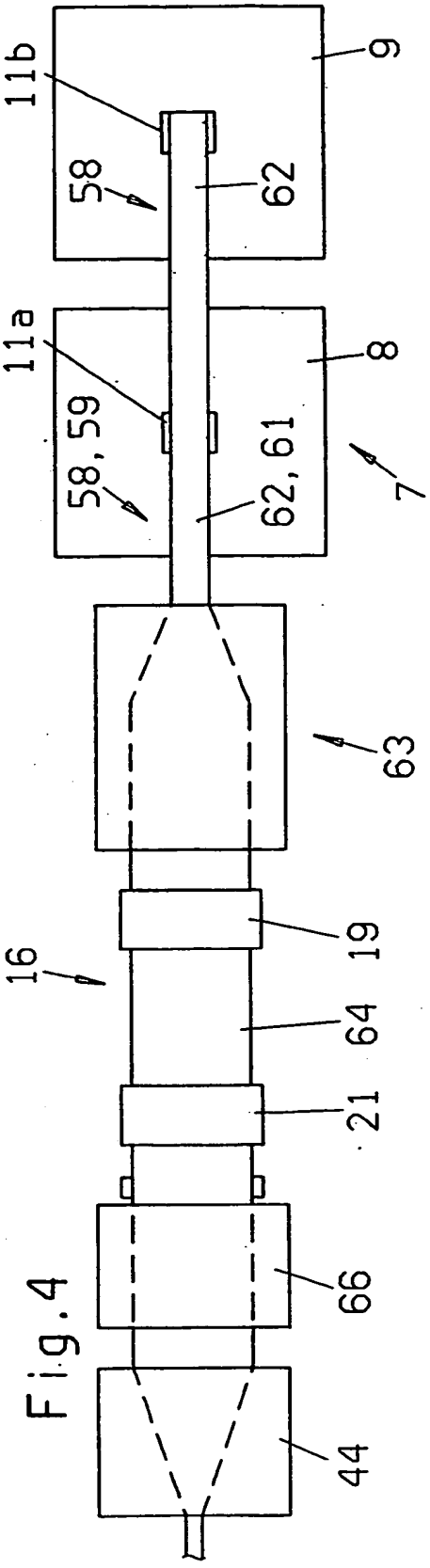


Fig.4

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METHOD OF AND MACHINE FOR MAKING FILTERS FOR ROD-SHAPED SMOKERS' PRODUCTS

The invention relates to improvements in methods of and in apparatus for making filter mouthpieces. More particularly, the invention relates to improvements in methods of and in apparatus for making filter rods which can be subdivided into rod-like sections of required length and contain fibrous fillers. Still more particularly, the invention relates to improvements in methods of and in apparatus for processing so-called filter tows which are to constitute or form part of fillers within the wrappers of filter rods.

Filter mouthpieces for use in so-called filter tipping and like machines are normally produced in machines of the type disclosed, for example, in commonly owned U.S. Pat. No. 5,060,664 (granted October 29, 1991 to Wolfgang Siems et al. for "Method of and apparatus for making streams containing fibrous materials of the tobacco processing industry") and in U.S. Pat. No. 4,511,420 (granted April 16, 1985 to Hugh M. Arthur for "Continuous rod manufacture"). The disclosures of these patents, and of all other U.S. patents mentioned in this specification, are incorporated herein by reference. The patents to Siems et al. and Arthur disclose machines wherein an elongated tow of fibrous filter material for tobacco smoke (such as cellulose acetate fibers) is drawn from a bale through spreading, stretching and plasticizer applying stations prior to entering a wrapping station wherein the thus treated tow is draped into a web of cigarette paper, imitation cork or other suitable wrapping material to form with the wrapper a continuous filter rod which is ready to be subdivided into sections of desired length. The filter rod sections can be transported into a filter tipping machine to be attached to plain cigarettes, cigars or cigarillos with attendant conversion of such tobacco-containing products into filter cigarettes, cigars or

cigarillos. A frequently employed plasticizer is triacetin which bonds portions of neighboring fibers to each other and thus establishes a maze of passages for the flow of tobacco smoke from the lighted end of a cigarette, cigar or cigarillo into a smoker's mouth. The plasticizer can constitute but one of numerous additives which are known to be applied to or mixed with the fibers of a tow to form a continuous filler for the filter rod. For example, it is known to add granulae of activated carbon in order to further enhance the tobacco smoke filtering action of mouthpieces for cigarettes or other rod-shaped tobacco-containing products of the cigarette making and related industries.

A drawback of heretofore known methods of and of heretofore known machines for the making of filter mouthpieces is that their output does not satisfy the requirements of modern high-speed tipping machines for cigarettes or the like. Furthermore, the quality of filter rod sections which are turned out by one of a plurality of conventional filter rod making machines does not always match or sufficiently approximate the quality of filter rod sections which are turned out by other filter rod making machines in the same tobacco processing plant. For example, the weight, the resistance to the flow of tobacco smoke and/or other characteristics of filter rod sections which are turned out by one machine or one set of machines in a cigarette making plant can deviate, often to a considerable extent, from the corresponding characteristic or characteristics of filter rod sections which are turned out by the other machine or by the other set of machines in the same plant. Differences in the quality of filter rod sections are annoying to the smokers and can also affect the ability of certain filter rod sections to intercept adequate quantities of tar, nicotine and/or other ingredients which are to be gathered by satisfactory

filters for tobacco smoke.

One feature of the present invention resides in the provision of a method of processing fibrous filter material for the making of filter products, particularly filter rod sections which can be attached to plain cigarettes, cigars or cigarillos. The improved method comprises the steps of simultaneously advancing a plurality of tows of fibrous material along neighboring paths from a source of supply, at least substantially simultaneously spreading the advancing tows, at least substantially simultaneously stretching the advancing tows prior or subsequent to spreading, at least substantially simultaneously applying at least one additive (e.g., a plasticizer) to the advancing tows, and thereafter subjecting the tows to at least one further treatment. Such further treatment can include draping each tow into a web of suitable wrapping material and subdividing the resulting filter rods into sections of desired length.

The advancing step can comprise simultaneously withdrawing two substantially strip-shaped tows from a common source of supply. The aforementioned step of subjecting the tows to at least one further treatment can include maintaining the tows close to each other.

At least one of the spreading, stretching and applying steps can be carried out upon the tows in their respective paths.

The advancing step can include transporting the tows along neighboring paths which are disposed side-by-side; such tows can be maintained in a common plane.

Alternatively, the advancing step can comprise transporting the tows along neighboring paths which are disposed at different levels. Such advancing step can further comprise maintaining at least one portion of one of the paths in immediate proximity to at least one portion of another path so that the respective tows overlie each other

in such portions of their paths. The tows can actually contact each other in the immediately adjacent portions of their paths. At least one of the spreading, stretching and applying steps can be carried out upon the tows in the one path and in the other path while the respective tows are advanced along the aforementioned immediately adjacent portions of their paths.

The spreading and applying steps can be carried out simultaneously upon the tows in their respective paths.

Another feature of the invention resides in the provision of a machine for making filter rods for smokable materials, such as plain cigarettes, cigars or cigarillos. The machine comprises a source of a plurality of filter tows, means for advancing the tows in a predetermined direction along neighboring paths, means for spreading the advancing tows, means for stretching the advancing tows, and means for applying to the advancing tows at least one additive.

The source can be constructed and assembled to receive two filter tows, particularly two bales each of which can contain a supply of filter tow.

At least one of the spreading, stretching and applying means can be common to the plurality of tows. Such at least one means can include portions extending across all of the paths.

At least one of the spreading, stretching and applying means can include an adjustable treating portion for each of the tows and means for adjusting each treating portion independently of the other treating portion or portions.

In accordance with a presently preferred embodiment, the stretching means includes an adjustable stretching portion for each tow and means for adjusting each stretching portion independently of the other stretching portion or portions.

At least the major portions of the paths can be coplanar.

Alternatively, the paths can include portions which are disposed at different levels. Such paths can include additional portions wherein the tows in neighboring paths overlie each other, and at least one of the spreading, stretching and applying means can be installed adjacent the additional portions of such paths. The at least one means can constitute the stretching means.

The stretching means can include a pair of stretching rolls extending across the paths and engaging all of the tows, means for driving the stretching rolls, discrete adjustable brakes for the tows, and means for adjusting the brakes independently of each other.

Alternatively, the stretching means can comprise a first pair of stretching rolls extending across the paths, a second pair of stretching rolls extending across the paths downstream of the first pair of stretching rolls, means for driving the rolls of the first pair at a first speed, and means for driving the rolls of the second pair at a higher second speed.

The applying means can comprise a housing for portions of the paths, adjustable additive applicators for the tows in the aforementioned portions of the paths (such applicators can include discrete pumps), and means for adjusting the applicators independently of each other.

The source can be located at a first level and the spreading means can be located at a second level above the first level. The stretching means of such machine can include means for deflecting the tows from first into second portions of the respective paths. The deflecting means can comprise a discrete brake for each tow.

It is possible to provide a source which comprises two discrete bales of tow, and the advancing means then comprises means for transporting discrete tows

from the bales along the respective paths.

Alternatively, the source can comprise a single bale of tow, and the advancing means can comprise means for transporting discrete tows from the single bale along the respective paths.

If the source comprises a bale of tow having a multiple unit width, the machine can further comprise means for dividing the tow of multiple unit width into the aforementioned plurality of tows which are advanced along the respective paths. The dividing means can be installed upstream of or within the stretching means.

The machine can further comprise means for processing each tow into a filter product (such as a continuous filter rod) downstream of the spreading, stretching and applying means, means for monitoring at least one characteristic of each filter product and for generating signals denoting the characteristics of the respective filter products, and means for comparing the signals including means for generating additional signals which denote differences between the compared signals. Still further, such machine can comprise means for adjusting at least one of the spreading, stretching and applying means for at least one of the plurality of tows in response to the additional signals. The adjustment is carried out in a sense to eliminate differences between the compared signals. Such machine can further comprise a source of reference signals, means for comparing the additional signals with reference signals, and means for adjusting the advancing means when the additional signals differ from the reference signals. The adjustment is or can be carried out for the purpose of eliminating differences between the additional signals and the reference signals.

The novel features which are considered as characteristic of the invention are set forth in particular

in the appended claims. The improved machine itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain presently preferred specific embodiments with reference to the accompanying drawings.

FIG. 1 is a schematic elevational view of a filter rod making machine which embodies one form of the invention;

FIG. 2 is a schematic plan view of the machine which is shown in FIG. 1;

FIG. 3 is a fragmentary schematic elevational view of a second machine; and

FIG. 4 is a schematic plan view of the structure which is shown in FIG. 3.

FIGS. 1 and 2 illustrate certain details of a filter rod making machine 1 which embodies one form of the present invention. Those standard parts of the machine which are not indispensable for a full understanding of the claimed invention and are disclosed in the aforementioned U.S. patents to Siems et al. and Arthur and/or form part of other standard machines are omitted in FIGS. 1 and 2 for the sake of clarity. Such parts include, among others, the machine frame, various supports, bearings, walls, jackets and others.

The improved filter rod making machine 1 comprises a source 7 of filamentary filter material (such as cellulose acetate fibers) which is constructed and configurated to simultaneously accept two bales 7, 8 of filamentary filter material. The filter material is normally supplied in the form of so-called tows (two shown at 4 and 6) which must be processed on their way toward a rod forming unit 44 so that they can be converted into the rod-shaped fillers of the respective rods. As a rule, the processing involves spreading of the normally strip-shaped tows 4, 6 to increase their width, stretching the filaments of the spread-out tows, and contacting the spread-out and stretched tows with at least one additive, normally a liquefied softening agent (such as triacetin). The softening agent causes neighboring fibers of the spread out and stretched tows to adhere to each other and to thus convert each tow (particularly subsequent to transformation into a rod-like filler) into a body defining a maze of passages for the flow of tobacco smoke toward the mouth of the smoker. It is also possible to admix to the tows granulae of activated carbon or other materials which enhance the filtering capacity of the ultimate products.

A feature of the present invention resides in that the machine 1 is capable of simultaneously processing

a plurality of filter tows. This renders it possible to greatly increase the output and/or to ensure gentler treatment of filter tows because the tows need not be transported, spread out, stretched and/or otherwise manipulated at a very high speed if the output of the machine 1 need not greatly exceed the output of a presently available machine, such as that disclosed in the U.S. patent to Siems et al. For the sake of simplicity, the illustrated machine 1 is designed to simultaneously process only two filter tows 4 and 6. These tows are respectively transported along two neighboring elongated paths 2 and 3 by a common advancing mechanism including a pair of rollers 42, 43 driven by a variable-speed motor 41. The paths 2, 3 for the respective tows 4, 6 are located side-by-side and are coplanar, at least at those locations where the two tows are subjected to various treatments.

The bales 8 and 9 which are shown in FIG. 2 can be replaced with a single bale which stores a plurality of tows, such as the tows 4 and 6.

The source 7 is installed at a level below a deflector 11 which can be made of a metallic or other sheet material and not only serves to incline the adjacent portions of the paths 2, 3 at an angle of nearly 180° relative to each other but also forms part (a) of a spreading unit which increases the width of the tows 4, 6 on their way toward a stretching unit 16 and/or (b) of the stretching unit. As can be seen in FIG. 2, the deflector 11 includes two aligned portions or sections 12, one for each of the tows 4, 6 and each extending across the adjacent portion of the respective path 2, 3. The spreading unit further comprises three so-called banding devices 13, 14 and 27 each of which can be of the type described and shown, for example, in commonly owned U.S. Pat. No. 4,259,769 granted April 7, 1981 to Heinz Greve et al. for "Method and apparatus for banding tows of

filamentary material". Each of the three banding devices 13, 14, 27 extends across the two paths 2 and 3. The banding device 13 is installed upstream of the deflector 11, the banding device 14 is installed downstream of the deflector 11 (between the deflector and the stretching unit 16) and the banding device 27 is installed downstream of the stretching unit 16, namely between the unit 16 and a further unit 29 which serves as a means for applying a plasticizer, such as triacetin. The purpose of the spreading unit is to increase the width of each of the tows 4, 6 for more satisfactory stretching in the unit 16 as well as for more uniform distribution of atomized plasticizer which is supplied and applied by the unit 29.

The stretching unit 16 is constructed and assembled in such a way that the stretching action upon the filaments of the tow 4 can be regulated independently of stretching action upon the tow 6 and vice versa. This renders it possible to influence one or more characteristics of the ultimate products (filter rod sections), primarily for the purpose of ensuring that all desirable characteristics of filter rod sections which include portions of the tow 4 will match the corresponding characteristics of filter rod sections including portions of the tow 6. The stretching unit 16 comprises a first pair of adjustable braking rolls 17 for the tow 4 and a second pair of adjustable braking rolls 18 for the tow 6. Each of the two braking rolls 17 is coaxial with one of the braking rolls 18, and these pairs of adjustable braking rolls are installed in the frame of the machine 1 upstream (as seen in the direction of arrow 28 which indicates the direction of pull upon the tows 4, 6 by the advancing rollers 42, 43) of two pairs of adjustable stretching rolls 19 and 21. At least one of the stretching rolls 19 is driven by a first adjustable prime mover 24, and at least one of the stretching rolls 21 is driven by a second

adjustable prime mover 26 independently of the prime mover 24.

Two additional adjustable prime movers 22 and 23 are provided to respectively drive the braking rolls 17 and 18 in synchronism with or independently of each other. These prime movers serve to regulate the braking action of the rolls 17, 18 upon the respective tows 4, 6. For example, the prime movers 22, 23 can constitute electric brakes which serve to apply variable torque to the respective rolls 17 and 18. However, it is equally possible to employ hydraulically or pneumatically operated braking devices which can urge the rolls of the respective pairs of rolls 17, 18 toward each other with a variable force and to thus select the extent of slippage of filaments forming the tows 4, 6 relative to the peripheral surfaces of the respective rolls 17 and 18.

The prime mover 26 drives at least one roll of the pair of stretching rolls 21 at a peripheral speed exceeding the peripheral speed of the stretching rolls 19 (at least one of which is driven by the prime mover 24). This ensures that the filaments of the tows 4, 6 are stretched to a selected extent during advancement across the space between the pairs of stretching rolls 19 and 21. Each of the stretching rolls 19 and 21 extends transversely across the paths 2 and 3. On the other hand, the braking rolls 17 extend only across the path 2 and the braking rolls 18 extend only across the path 3. It will be seen that the upper rolls of each of the pairs of rolls 17, 18, 19 and 21 are omitted in FIG. 2.

Successive increments of the tows 4, 6 advance (in the direction of arrow 28) beyond the stretching unit 16 and the third banding device 27 to enter the housing or casing 31 of the third unit 29 which is designed to apply atomized plasticizer to individual filaments of the tows before such increments reach the advancing rollers 42, 43.

The housing 31 confines the adjacent portions of the tows 4, 6 and contains a rotary cylindrical brush 32 which extends across the adjacent portions of the paths 2 and 3 and is driven by a variable-speed motor 33. Plasticizer is supplied from below through two discrete openings or windows 34 in the bottom wall of the housing 31 by two discrete variable-delivery pumps 36, one for each of the tows 4 and 6. It is also possible to provide a single window 34 for admission of plasticizer for both tows. The pumps 36 constitute adjustable treating portions of the unit 29 and draw plasticizer from a suitable source 37. The surplus of plasticizer is conveyed from the housing 31 back to the source 37 through a conduit 38 containing an adjustable valve 40. Each of the two pumps 36 can be adjusted independently of the other pump to deliver a selected quantity of plasticizer per unit of time. The quantity of applied plasticizer can influence the resistance which the filler of the finished product offers to the flow of tobacco smoke from the lighted end of a rod-shaped smokers' product into the mouth of a smoker. Two regulators 39 are provided, one for each of the pumps 36, to adjust the pumps and to thus select the quantity of plasticizer which is supplied to the respective tows 4, 6 per unit of time.

It will be seen that the characteristics of the tows 4, 6 can be individually influenced by the stretching unit 16 as well as by the plasticizer applying unit 29.

The advancing rollers 42, 43 are driven at a speed which is selected by the motor 41 to deliver the properly processed tows 4, 6 next to each other into the filter rod making unit 44. The tows 4, 6 are converted into the fillers of two discrete filter rods each of which is (or can be) subdivided by a so-called cutoff into filter rod sections of desired length, e.g., into filter rod sections of double unit length. Each filter rod section of

double unit length can be admitted into a tipping machine (e.g., a machine of the type known as MAX produced and distributed by the assignee of the present application) where it is assembled with two plain cigarettes, cigarillos or cigars of unit length to jointly form a filter cigarette, cigarillo or cigar of double unit length. Certain details of a rod making unit which can be used (at 44) in the machine 1 of FIGS. 1 and 2 are disclosed in the aforementioned U.S. patent to Siems et al. Reference may also be had to numerous other U.S. patents of the assignee of the present application, for example, to U.S. Pat. No. 3,974,007 (granted August 10, 1976 to Heinz Greve for "Method and apparatus for the production of filter rod sections or the like") and/or to U.S. Pat. No. 4,132,189 (granted January 2, 1979 to Heinz Greve et al. for "Apparatus for applying plasticizer to fibrous filter materials in filter rod making machines"). U.S. Pat. No. 4,132,189 to Greve et al. further describes and shows several embodiments of plasticizer applying units which can be used (with rather minor modifications) in the machine 1 of FIGS. 1 and 2. Additional plasticizer applying units which can be used in the machine 1 of the present invention are disclosed, for example, in commonly owned U.S. Pat. No. 4,317,425 (granted March 2, 1982 to Heinz Greve et al. for "Apparatus for applying plasticizer to fibrous filter material in filter rod making machines") and/or in commonly owned U.S. Pat. No. 4,510,885 (granted April 16, 1985 to Heinz Greve et al. for "Apparatus for applying atomized plasticizer to a running tow of filamentary filter material").

The rod making unit 44 is associated with or comprises means for monitoring at least one characteristic of each of the two series of products which are turned out by the machine 1. FIG. 1 shows two monitoring devices 46, 47 which transmit signals denoting the characteristics of

the monitored products to an evaluating circuit 48 as well as to a signal comparing circuit or stage 49. The evaluating circuit 48 compares the signals from the monitoring devices 46, 47 (i.e., signals which are generated as a result of monitoring of products respectively containing portions of the tows 4 and 6) and generates corresponding difference signals when the characteristics (e.g., intensities) of signals from the monitoring device 46 depart from those of signals which are generated by the monitoring device 47. The difference signals which are transmitted by the output of the evaluating circuit 48 are or can be utilized to adjust the prime mover 22 and/or 23 in a sense and for the purpose of eliminating (or at least minimizing) the differences between signals which are transmitted by the monitoring devices 46 and 47.

The output of the signal comparing stage 49 is connected to a control circuit 51. The latter is further connected to a source 52 of reference signals. Such reference signals denote the desired characteristics of finished products which are monitored by the devices 46 and 47. If the difference between the characteristics of signals compared in the stage 49 does not depart from a permissible range of tolerances, the control circuit 51 does not transmit a signal, or does not alter the signal which is being transmitted to the adjustable prime mover 43 for the advancing rollers 41, 42, i.e., the speed of advancement of tows 4, 6 in the direction of arrow 28 remains unchanged. As shown in FIG. 2, the signal at the output of the control circuit 51 is further transmitted to the prime movers 24, 26, 33 and to the pumps 36 so that the pumps and the parts which are driven by the prime movers 24, 26, 33 are adjusted in synchronism with adjustment of the prime mover 43. Any change of speed of the advancing rollers 41, 42 results in a change of speed of the

processed webs 4, 6 which enter the rod making unit 44 relative to the mobile parts of the unit 44, and such adjustment of the speed of the tows 4, 6 preferably takes place (or can take place) without any changes in relative speeds of various mobile parts of the machine 1 upstream of the rod making unit 44. This renders it possible to alter the monitored characteristics of final products, which are turned out in the unit 44, in a sense to more closely approach or to match the desired or optimum characteristics.

The monitoring devices 46 and 47 can be designed to ascertain the density (weight) of finished products and/or the resistance of the fillers of finished products to the flow of smoke therethrough. Of course, it is equally possible to monitor other characteristics in addition to or in lieu of density and/or resistance to the flow of smoke and to use the corresponding signals to carry out necessary adjustments of the speed of advancing rollers 41, 42 and/or the action of the stretching device 16 and/or the rate of application of plasticizer by the unit 29.

The density (weight) of discrete rod-shaped products can be monitored by commercially available beta ray detectors. Reference may be had, for example, to commonly owned U.S. Pat. No. 4,283,998 granted August 18, 1981 to Heinz Greve et al. for "Method and machine for making a filter rod". Alternatively, beta ray detectors can be used jointly with (or they can be replaced by) other monitoring devices, e.g., detectors which are designed to direct beams of infrared radiation against the filter rods or sections of filter rods. The resistance of finished products to the flow of tobacco smoke therethrough can be monitored by devices of the type disclosed, for example, in commonly owned U.S. Pat. No. 4,223,551 granted September 23, 1980 to Heinz Greve et al. for "Apparatus for ascertaining the resistance of cigarettes or the like to

axial flow of gases therethrough". The patented monitoring apparatus employs a drum-shaped conveyor and pneumatic sensors which ascertain the rate of fluid flow through rod-shaped articles of the tobacco processing industry.

When the machine 1 is in use, the source 7 contains two discrete bales 8, 9 or a single bale containing a plurality of tows, and the motor 43 drives the advancing rollers 42, 43 which draw the tows 4, 6 in the direction of arrow 28. The tows 4, 6 are spread out by the banding device 13 to be thereupon caused to change the direction of their advancement from upwardly and away from the source 7 to downwardly and past the second banding device 14 and thence into the range of the stretching unit 16. Some preliminary stretching of the tows 4, 6 takes place under the action of gravity while the tows advance from the (lower) level of the source 7 to the (higher) level of the deflector 11. The tows 4, 6 are individually stretched between the respective braking rolls 17, 18 and the common stretching rolls 19. The prime movers 22, 23 adjust the braking action of the respective pairs of rolls 17, 18 in order to eliminate differences (if any) between the monitored (by 46, 47) densities and/or flow resistances of products containing the respective tows. As already mentioned above, the prime movers 22, 23 adjust the respective pairs of braking rolls 17, 18 in a sense to eliminate (or at least minimize) the differences between the characteristics of products containing portions of the tow 4 and products containing portions of the tow 6.

The tows 4, 6 are jointly stretched between the pairs of stretching rolls 19 and 21. These pairs of rolls are driven at different peripheral speeds by the respective prime movers 24 and 26. The repeatedly stretched tows 4, 6 are thereupon spread out (widened) by the common banding device 27 prior to entering the housing 31 of the plasticizer applying unit 29. The rate of delivery of

plasticizer by the pumps 36 can be regulated by the respective regulators 39 so that the quantity of plasticizer which is applied to the tow 4 per unit length can depart from the quantity of plasticizer which is applied to the tow 6 per unit length. Such adjustability of application of plasticizer to the tows 4 and 6 also contributes to the ability of the improved machine 1 to select the processing of the tow 4 (or certain stages of processing of the tow 4) independently of the processing of the tow 6 and/or vice versa. Such separate adjustability is desirable because the manufacturer normally wishes to ensure that all of the products which are turned out by the machine (regardless of whether they contain portions of the tow 4 or portions of the tow 6) will exhibit identical properties or because the manufacturer wishes to ensure that the properties of products containing portions of the tow 4 will depart to a predetermined extent from the corresponding properties of products containing portions of the tow 6.

The next stage of processing involves the admission of successive increments of the properly spread out, stretched and plasticized tows 4 and 6 into the rod making unit 44 which assembles the tows with discrete webs of wrapping material into two continuous filter rods serving to yield filter rod sections of unit length or multiple unit length.

The character 53 denotes in FIG. 1 a dividing or separating apparatus which can be put to use if the source 7 contains a bale consisting of a single convoluted or otherwise stored tow of multiple (double) unit width. The purpose of the apparatus 53 is divide such wide tow into two discrete tows in the region between the banding device 14 and the stretching unit 16, and the thus obtained discrete tows are thereupon stretched and provided with plasticizer in the same way as described above in

connection with the tows 4 and 6. The dividing apparatus 53 of FIG. 1 comprises a nozzle 54 which is connected to a source 56 of pressurized fluid (e.g., to a source of compressed air) and discharges one or more jets or streams of such fluid to thus halve the single tow issuing from the source 7 in lieu of the illustrated discrete tows 4 and 6. A funnel-shaped or another suitable fluid collecting and/or guiding device 57 is installed in line with the orifice or orifices of the nozzle 54 to receive and to lead away the jet or jets of pressurized fluid which is or are used to divide a relatively wide single tow into two narrower tows.

The illustrated dividing apparatus 53 can be replaced with any other suitable apparatus which is capable of dividing a relatively wide tow of fibrous filter material into a plurality of narrower tows. For example, the source 57, the nozzle 54 and the fluid collecting and/or guiding device 57 can be replaced with a rod (not shown) which extends across the path for the single tow and automatically divides such single tow into two narrower tows when the motor 43 is on to drive the advancing rollers 42, 43 or equivalent means for transporting a single tow or a plurality of discrete tows away from the source 7 and toward and past the dividing apparatus.

FIG. 1 shows a deflector 11 which is made of suitably shaped metallic or other sheet material and includes the two aligned sections or portions 12 shown in FIG. 2. This simple deflector can be replaced with an even simpler deflector wherein the two sections or portions 12 are of one piece with each other, or with a more complex deflector, e.g., a deflector having a single idler roller or two coaxial idler rollers, one for each of the illustrated tows 4, 6. Still further, the portions or sections 12 of the illustrated deflector 11 can be omitted and such deflector can be constituted by the two pairs of braking rolls 17 and 18, i.e., the braking rolls 17, 18 can

be transferred from the locations which are shown in FIGS. 1 and 2 into the space which is occupied by the deflector 11.

An important advantage of the improved filter rod making machine 1 is that its output matches, or can match, the outputs of a plurality of standard machines but its space requirements and its cost are a fraction of the space requirements and cost of plural conventional machines. This is due to the fact that at least certain units which are used to advance and/or process the tows 4, 6 are common to the two tows or are in part common to such plural tows. For example, each of the banding devices 13, 14 and 27 is common to the tows 4, 6, the same as the deflector 11, the housing 31 of the unit 29 and the rolls 19, 21 of the unit 16. Furthermore, the utilization of common parts in connection with the advancement and/or processing of plural tows contributes to uniformity of treatment of the tows, e.g., to equal spreading and/or to joint advancement toward the rod making unit 44. The provision of a common motor 41 for the advancing rolls 42, 43, of a common plasticizer source 37 for the pumps 36, and of common drives 24, 26 for the stretching rolls 19 and 21 also contributes to simplicity, compactness and lower cost of the improved machine. At the same time, the individually adjustable braking rolls 17, 18, the individually adjustable stretching rolls 19, 21 and the individually adjustable pumps 36 render it possible to eliminate or to intentionally establish differences between certain characteristics of rod-shaped products containing portions of the tow 4 and rod-shaped products containing portions of the tow 6. It often suffices if only one of the various units of the tow processing means is designed to permit independent treatment of the webs 4 and 6, as long as the one unit (e.g., the stretching unit 16) is capable of ensuring the elimination of differences between the two

sets of products or the establishment of predetermined differences between such sets of products. The utilization of a stretching unit 16 which can stretch the tows 4 and 6 independently of each other is particularly desirable in many instances because such stretching unit can directly influence at least two very important characteristics, namely the density and the resistance to the flow of smoke of the finished products.

As already mentioned above, the machine 1 can be set up to produce twice as many filter rod sections as a single conventional machine which is designed to draw a single tow of standard width from a single bale. Alternatively, the improved machine can be set up to process two or more tows while the tows advance at a speed which is less than the speed of a tow in a conventional machine for the making of a single filter rod. This ensures that the plural tows are treated gently which, in turn, enhances the quality of the ultimate products. Moreover, by advancing the plural tows at a relatively low speed, the improved machine even further enhances the possibility of ensuring that the characteristics of one set of ultimate products will match (or will depart to a predetermined extent from) the characteristics of each other set of ultimate products. The monitoring of ultimate products which respectively contain portions of properly processed tows 4, 6 can be carried out with a higher degree of accuracy if the tows are advanced at less than an extremely high maximum speed. Moreover, the number of rejects is reduced if the tows are not advanced at a maximum speed which would contribute to higher output but would possibly prevent the one or the other monitoring device from ascertaining the characteristics of successive portions of two or more sets of filter rod sections with an optimum degree of accuracy and reproducibility.

FIGS. 3 and 4 show certain portions of a modified

machine. All such parts of this modified machine which are identical with or clearly analogous to corresponding parts of the machine 1 of FIGS. 1 and 2 are denoted by similar reference characters. The machine of FIGS. 3 and 4 includes a source 7 including two bales 8, 9 which are disposed one behind the other (as seen in the direction of arrow 28) and respectively store two elongated tows 61, 62 of fibrous filter material, such as cellulose acetate. Two discrete deflectors 11a, 11b respectively guide the tows 61, 62 along two discrete paths 58, 59 which are disposed above each other starting from the regions of the deflectors 11a, 11b. Each of these deflectors can constitute an idler roller.

The first treating unit 63 of the machine which is shown in FIGS. 3 and 4 comprises one or more banding devices and/or other suitable means for spreading the tows 61, 62 in the respective portions of their paths 58, 59. The banding devices in the unit 63 cooperate with the deflectors 11a, 11b to spread the tows 61, 62 in order to permit more predictable stretching and subsequent application of triacetin or another suitable plasticizer. The treating unit 63 can further contain two discrete pairs of braking rolls, one pair for each of the tows 61, 62, and the braking rolls can be operated in the same way as described in connection with the pairs of braking rolls 17, 18 in the machine 1 of FIGS. 1 and 2.

In addition to the pairs of braking rolls at 63, the stretching unit 16 of the machine which is shown in FIGS. 3 and 4 further comprises two pairs of stretching rolls 19 and 21 which are or which can be driven at different peripheral speeds by discrete prime movers, not shown. The pairs of stretching rolls 19 and 21 establish in each of the paths 58, 59 a portion (shown at 64) wherein the tows 61, 62 are immediately adjacent to and overlap and contact each other. This ensures that the stretching rolls

19 and 21 can ensure equal stretching of the tows 61, 62 in the just mentioned portions (64) of the paths 58, 59, different stretching actions being achieved (when necessary) by adjusting the braking rolls for the tow 61 or 62, e.g., in a manner as described with reference to the machine 1 of FIGS. 1 and 2. The peripheral speed of the stretching rolls 21 exceeds the peripheral speed of the stretching rolls 19.

The tows 61, 62 are separated at 65, i.e., downstream of the stretching rolls 21 and prior to entering a unit 66 wherein they are individually treated with an additive, such as plasticizer, e.g., in a manner as described in connection with FIGS. 1 and 2. The thus processed tows 61, 62 are caused to enter the rod forming unit 4 which is or which can be identical with the unit 44 in the machine 1. Each of the processed tows 61, 62 is draped into a web of cigarette paper, imitation cork or other suitable wrapping material to form therewith a discrete filter rod which is ready to be subdivided into filter rod sections of unit length or multiple unit length prior to admission into storage or into a tipping machine.

The machine of FIGS. 3 and 4 is also equipped with means for monitoring one or more characteristics of the two sets of finished products and with means for adjusting at least one of the spreading, stretching and plasticizing units for the purpose of eliminating differences between the characteristics of the two sets of products or for establishing desirable (predetermined) differences between the characteristics of such products. The monitoring and adjusting or regulating means are or can be analogous to those already described in connection with and shown in FIGS. 1 and 2.

The machine of FIGS. 3 and 4 can be modified in a number of ways without departing from the spirit of the invention. For example, the tows 61, 62 can be caused to

directly overlap and contact each other during advancement through the treating unit 66, i.e., during application of plasticizer, e.g., by a simplified plasticizing unit which employs a single pump and a single adjuster or regulator for such pump.

An advantage of the machine of FIGS. 3 and 4 is that it occupies (or that it can be designed to occupy) even less space than the machine 1 of FIGS. 1 and 2. This can involve a reduction of the width and/or a reduction of the height of the machine of FIGS. 3 and 4 (as compared with the corresponding dimensions of the machine 1).

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the appended claims.

CLAIMS:

1. A method of processing fibrous filter material for the making of filter products, comprising the steps of simultaneously advancing a plurality of tows of fibrous filter material along neighboring paths from a source of supply; at least substantially simultaneously spreading the advancing tows; at least substantially simultaneously stretching the advancing tows; at least substantially simultaneously applying at least one additive to the advancing tows; and thereafter subjecting the tows to at least one further treatment.

2. The method of claim 1, wherein said advancing step comprises simultaneously withdrawing two substantially strip-shaped tows from a common source of supply.

3. The method of claim 2, wherein said step of subjecting the tows to at least one further treatment comprises maintaining the tows close to each other.

4. The method of claim 1, wherein at least one of said spreading, stretching and applying steps is carried out upon the tows in their respective paths.

5. The method of claim 1, wherein said advancing step comprises transporting the tows along neighboring paths which are disposed side-by-side.

6. The method of claim 1, wherein said advancing step comprises transporting the tows along neighboring paths which are disposed at different levels.

7. The method of claim 6, wherein said advancing step further comprises maintaining at least one portion of one of said paths in immediate proximity to at least one portion of another of said paths so that the respective tows overlie each other in said portions of their paths.

8. The method of claim 7, wherein the tows in said portions of said one path and said other path contact each other.

9. The method of claim 7, wherein at least one of said spreading, stretching and applying steps is carried out upon the tows in said one path and said other path while the respective tows are advanced along said portions of their paths.

10. The method of claim 1, wherein said spreading and applying steps are carried out simultaneously upon the tows in their respective paths.

11. A machine for making filter rods for smokable materials, comprising a source of a plurality of filter tows; means for advancing the tows along neighboring paths; means for spreading the advancing tows; means for stretching the advancing tows; and means for applying at least one additive to the advancing tows.

12. The machine of claim 11, wherein said source is constructed and assembled to receive two filter tows.

13. The machine of claim 11, wherein at least one of said spreading, stretching and applying means is common to the plurality of tows.

14. The machine of claim 13, wherein said at least one means includes portions extending across all of said paths.

15. The machine of claim 11, wherein at least one of said spreading, stretching and applying means includes an adjustable treating portion for each of the tows and means for adjusting each of said treating portions independently of each other treating portion.

16. The machine of claim 11, wherein said stretching means includes an adjustable stretching portion for each of the tows and means for adjusting each stretching portion independently of each other stretching portion.

17. The machine of claim 11, wherein at least the major portions of said paths are coplanar.

18. The machine of claim 11, wherein said paths include portions which are disposed at different levels.

19. The machine of claim 18, wherein said paths include additional portions wherein the tows in neighboring paths overlie each other, at least one of said spreading, stretching and applying means being adjacent said additional portions of said paths.

20. The machine of claim 19, wherein at least one means is said stretching means.

21. The machine of claim 11, wherein said stretching means includes a pair of stretching rolls extending across said paths and engaging all of the tows, means for driving said rolls, discrete adjustable brakes for the tows, and means for adjusting said brakes independently of each other.

22. The machine of claim 11, wherein said advancing means includes means for transporting the tows in a predetermined direction, said stretching means comprising a first pair of tow stretching rolls extending across said paths a second pair of tow stretching rolls extending across said paths downstream of said first pair, means for driving the rolls of said first pair at a first speed, and means for driving the rolls of said second pair at a higher second speed.

23. The machine of claim 11, wherein said applying means comprises a housing for portions of said paths, adjustable additive applicators for the tows in said portions of said paths, and means for adjusting said applicators independently of each other.

24. The machine of claim 11, wherein said source is located at a first level and said spreading means is located at a second level above said first level, said stretching means including means for deflecting the tows from first into second portions of the respective paths.

25. The machine of claim 24, wherein said deflecting means comprises a discrete brake for each tow.

26. The machine of claim 11, wherein said source comprises two discrete bales of tow, said advancing means including means for transporting discrete tows from said bales along the respective paths.

27. The machine of claim 11, wherein said source comprises a single bale of tow and said advancing means comprises means for transporting discrete tows from the single bale along the respective paths.

28. The machine of claim 11, wherein said source comprises a bale of tow having a multiple unit width and further comprising means for dividing said tow of multiple unit width into said plurality of tows.

29. The machine of claim 28, wherein said advancing means includes means for transporting said plurality of tows in a predetermined direction and said dividing means is located upstream of said stretching means.

30. The machine of claim 11, wherein said advancing means comprises means for advancing the tows in a predetermined direction and further comprising means for processing each tow into a filter product downstream of said spreading, stretching and applying means, means for monitoring at least one characteristic of each filter product and for generating signals denoting the respective characteristics, and means for comparing said signals including means for generating additional signals denoting the differences between compared signals.

31. The machine of claim 30, further comprising means for adjusting at least one of said spreading, stretching and applying means, for at least one of the plurality of tows in response to said additional signals in a sense to eliminate differences between compared signals.

32. The machine of claim 30, further comprising a source of reference signals, means for comparing said additional signals with reference signals, and means for adjusting said advancing means when the additional signals differ from the reference signals to thus eliminate differences between said additional signals and the reference signals.

33. A method of processing fibrous filter material for the making of filter products, substantially as herein described with reference to the accompanying drawings.

34. A machine for making filter rods for smokable materials, substantially as herein described with reference to the accompanying drawings.

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Databases (see over)

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Documents considered relevant following a search in respect of claims 1 TO 34

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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Category	Identity of document and relevant passages	Relevant to claim(s)

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